26. *PARAPOYNX DIMINUTALIS* SNELLEN (PYRALIDAE: LEPIDOPTERA) AS A SERIOUS PEST OF *NYMPHOIDES CRISTATUM* IN KEOLADEO NATIONAL PARK, BHARATPUR, RAJASTHAN

One of the notable changes after the ban of buffalo grazing in Keoladeo National Park, Bharatpur, is the shrinking of open water habitat as a result of the invasion by *Paspalum distichum*, a perennial, amphibious grass. The reduction of open water area in turn limits the growth of floating vegetation, especially members of the genera *Nymphoides* and *Nymphaea*. In order to prevent the excessive growth of *Paspalum distichum*, the park authorities bulldozed certain areas in 1985. A tremendous growth of *Nymphoides cristatum* and *Nymphoides indicum* along with *Nymphaea nouchali* and *Nymphaea stellata* was noticed in the opened up areas.

During August, 1985, the leaves of *Nymphoides cristatum* were infested and fed on by the larval forms of *Parapoynx diminutalis*. At first the attack was mild but by April-May, 1986, almost all the leaves of *Nymphoides cristatum* were destroyed by the larvae. The early larval stages were found inside the leaf epidermis, but later stages came out of the leaves and stayed inside leaf folds, which were made by partially cutting and folding the leaf margin towards their ventral surface. The larvae frequently came out of the leaf folds to feed on the rest of the leaves. Mainly because of the larvae, the growth of *Nymphoides cristatum* in the park was considerably reduced by June-July, 1986. The life-cycle and population density of *Parapoynx diminutalis* are being studied in detail.

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BNHS ECOLOGICAL RESEARCH CENTRE,
331, RAJENDRA NAGAR,
BHARATPUR - 321 001,
May 22, 1987.

GEORGE M. JOHN
C. NANJAPPA

27. LIFE TABLE STUDIES ON THE SPOTTED BOLLWORM *EARIAS VITTELLA* (FABRICIUS) (LEPIDOPTERA: NOCTUIDAE) IN COTTON ECOSYSTEM

INTRODUCTION

Life table is a systematic presentation of survival and mortality in a population (Harcourt 1969). It records the population or estimate of a species at sequential stages of the life cycle in its natural environment. In the present study on the population dynamics of the spotted bollworm *Earias vittella* (Fabricius) which is one of the serious pests of an economically important crop, viz. cotton, life tables were constructed with the observations recorded under field conditions.

Material and Methods

Life table studies were conducted in three different crop growth stages, viz. 60-80 DAS, 80-100 DAS, 100-120 DAS. MCU 5 cotton was sown on September 1, 1984, in an area of 567 sq. m. and this area was divided into 63 plots, each of 9 sq. m. Twenty one plots were allocated for the studies in every crop growth stage. These plots formed three replicates for seven samples which were distributed randomly, and 0.5 m space was maintained between plots to minimize the chances of migration of population of *E. vittella.*

E. vittella was reared in the laboratory at 28°±2°C and 85±5% R. H. using the growth chamber which was the prevailing atmospheric temperature and humidity during the study time. Female moths were made to lay eggs on muslin cloth provided as site for oviposition. The muslin, containing eggs, was clipped into small pieces so as to have 10 eggs on each piece of muslin. In each plot, ten plants were randomly selected and the piece of muslin containing 10 eggs was tied to the tip of each plant. This was done on 60 DAS, 80 DAS and 100 DAS for the studies in different crop growth stages respectively. Before placing the eggs, the plants were thoroughly examined for the eggs of *E. vittella* and these, if present were removed.

All the eggs from the first sample plots were collected two days after egg placement, brought to the laboratory and reared for emergence of parasites, if any. On the third day after egg placement, the eggs were counted in the second sample plots to know the extent of predation. Subsequently, on the fourth day after egg placement, observations were made on the non-fertile eggs and first instar larvae of *E. vittella* in third sample plots. All the fruiting bodies were cut open and examined for the number of live and dead I instar larvae. The dead larvae collected were kept in the laboratory to look for any parasite emergence. Observations were recorded in a similar way in the fourth, fifth and sixth sample plots for II, III and IV instar larvae respectively. Observations on the seventh sample plots were made for the number of cocoons, as pupation generally took place on the plant parts. The cocoons collected were reared in the laboratory for the emergence of adults and the sex ratio was established. The emergence of parasites from the cocoons, if any, were also recorded. The column headings used in the life table were those proposed by Morris and Miller (1954) and Harcourt (1969).

Results

a) *Life table on cotton* 60-80 DAS (Table 1)

During egg stage, there was a total mortality of 27.3%, of which 11.1% was due to non-fertility and 16.2% was due to predation by *Menochilus sexmaculatus.* The maximum mortality (64.1%) during the larval stages was seen in the I instar stage, which was due to inability to establish the population. The mortality at the II instar stage was 13.8% which was due to unknown reasons. There was 25.3% mortality due to unknown reasons in the III instar stage. During the IV instar stage, 40.5% mortality was observed, which was also due to unknown reasons. Parasitisation to the extent of 0.8% due to *Tetrastichus* sp. was noticed during the pupal stage. This parasite has been found to be new to science and is being described elsewhere. There was also 13.0% parasitisation in the pupal stage by *Agathes* sp. The trend index was 1.94 and the generation survival was 0.032.

b) *Life table on cotton* 80-100 DAS (Table 2).

There was 12.3% predation by *M. sexmaculatus* and 26.8% non-fertility during the egg stage. Very high mortality of 72.1% was recorded in the I instar stage, which was due to inability to establish the population. During II, III, IV instars and pupal stage, the mortality was due to unknown reasons and it was 22.9%, 22.9%, 18.8% and 13.4% respectively. The trend index was 3.19 and generation survival was 0.12.

c) *Life table on cotton* 100-120 DAS (Table 3).

There was 16.5% predation by *M. sexmaculatus* and 37.3% non-fertility during egg stage. The I instar suffered 72.1% mortality due to the inability to establish the population. The mortality in II, III and IV instar larval stages were due to unknown reasons and were 13.2%, 21.4% and 12.5% respectively. The mortality during pupal stage was 74.1% which was due to unknown reasons and was high as in I instar stage. The trend index was 0.835 and generation survival was 0.043.

TABLE 1

LIFE TABLE OF *Earias vittella* ON COTTON 60-80 DAS SOWN IN SEPT. 1984

Age interval	No. alive at beginning of x	No. dying during x	Factors responsible for dx	dx as % of lx	Survival rate within x	log of lx	K value
(x)	(lx)	(dx)	(dxF)	(100qx)	(sx)	log lx	K
Eggs	1000	162	Predation	16.2			
		111	Non-fertility	11.1	0.727	3.000	0.138
I instar (N_1)	727	466	Inability to establish	64.1	0.359	2.862	0.445
II instar	261	36	Unknown reasons	13.8	0.862	2.417	0.065
III instar	225	57	Unknown reasons	25.3	0.747	2.352	0.127
IV instar	168	68	Unknown reasons	40.5	0.595	2.225	0.225
Pupae	100	34	Unknown reasons	34.0			
		8	Parasitisation due to *Tetrastichus* sp.	8.9			
		13	Parasitisation due to *Agathes* sp.	13.0	0.450	2.000	0.347
Adults (N_2)	45					1.653	0.653
Females	10					1.000	

No. of eggs laid 1923

Generation survival $\frac{N_3}{N_1} = 0.032$

No. of I instar in the next generation (N_2) 1410

Trend index $\frac{N_2}{N_1} = 1.94$

TABLE 2

LIFE TABLE OF *Earias vittella* ON COTTON 80-100 DAS SOWN IN SEPT. 1984

Age interval	No. alive at beginning of x	No. dying during x	Factors responsible for dx	dx as % of lx	Survival rate within x	log of lx	K value
(x)	(lx)	(dx)	(dxF)	(100qx)	(sx)	log lx	K
Eggs	1000	123	Predation	12.3			
		268	Non-fertility	26.8	0.809	3.000	0.215
I instar (N_1)	609	439	Inability to establish	72.1	0.279	2.785	0.555
II instar	170	39	Unknown reasons	22.9	0.771	2.230	0.113
III instar	131	30	Unknown reasons	22.9	0.771	2.117	0.113
IV instar	101	19	Unknown reasons	18.8	0.812	2.004	0.09
Pupae	82	11	Unknown reasons	13.4	0.866	1.914	0.063
Adults (N_3)	71					1.851	0.404
Females	28					1.447	

No. of eggs laid 3156 Generation survival $\frac{N_3}{N_1} = 0.12$

No. of I instar in the next generation (N_2) 1941 Trend index $\frac{N_2}{N_1} = 3.19$

TABLE 3

LIFE TABLE OF *Earias vittella* ON COTTON 100-120 DAS SOWN IN SEPT. 1984

Age interval	No. alive at beginning of x	No. dying during x	Factors responsible for dx	dx as % of lx	Survival rate within x	log of lx	K value
(x)	(lx)	(dx)	(dxF)	(100qx)	(sx)	log lx	K
Eggs	1000	165	Predation	16.5			
		373	Non-fertility	37.3	0.462	3.000	0.335
I instar (N_1)	462	333	Inability to establish	72.1	0.279	2.665	0.554
II instar	129	17	Unknown reasons	13.2	0.868	2.111	0.062
III instar	112	24	Unknown reasons	21.4	0.786	2.049	0.105
IV instar	88	11	Unknown reasons	12.5	0.875	1.944	0.058
Pupae	77	57	Unknown reasons	74.1	0.260	1.886	0.585
Adults (N_3)	20					1.301	0.301
Females	10					1.000	

No. of eggs laid 642 Generation survival $\frac{N_3}{N_1} = 0.043$

No. of I instar in the next generation (N_2) 386 Trend index $\frac{N_2}{N_1} = 0.835$

DISCUSSION

The trend index was positive during 60-80 DAS and 80-100 DAS and negative during 100-120 DAS. There was approximately two-fold increase of population during 60-80 DAS and three-fold increase during 80-100 DAS. During these periods, the cotton flower and cotton bolls formed the larval food. The net reproductive rate in life table studies conducted in laboratory conditions with cotton flowers and bolls as larval food were 93.17 and 93.96 respectively (Ambegaonkar and Bilapate 1982). Such high reproductive rate of the moth, in spite of the low generation survival, can be attributed to the trend index which was positive during 60-100 DAS. During 100-120 DAS the trend index was negative, indicating decline in the population.

The prevalence of the predation of *E. vittella* eggs by *M. sexmaculatus* was observed in all the stages, and pupal parasitisation by *Agathes* sp. and *Tetrastichus* sp. was observed only during 60-80 DAS. The predation of *E. vittella* eggs by *M. sexmaculatus* has already been reported by Das and Basu (1977), and the occurrence of *Agathes* sp. on *E. vittella* has been reported by Cherian and Kylasam (1941).

Tetrastichus sp. as a pupal parasite of *E. vittella* recorded during this study formed the first report.

CONCLUSION

Owing to the meagre occurrence of natural enemies in the ecosystem and also to the positive trend index during 60-100 DAS, it is evident that the mortality factors existing in nature during these periods were not effective in checking population growth of *E. vittella*. The need for taking up proper plant protection measures during 60-100 DAS cotton is revealed.

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FREDRICK INSTITUTE OF PLANT
PROTECTION AND TOXICOLOGY,
PADAPPAI-601 301, INDIA,
October 22, 1986.

D. ARUL SAMRAJ
B. V. DAVID[1]

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[1] *Present address*: Rhone-Poulenic Agrochemicals (India) Limited, May Baker House, Worli, Bombay-400 025.

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